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MacFarland

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(54) **PROCESS FOR THE ATTACHMENT OF A MOUNTING RAIL AS WELL AS A CONNECTING DEVICE FOR A MOUNTING RAIL**

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(52) **U.S. Cl.** **29/510**; 29/525.06; 403/279
(58) **Field of Search** 29/510, 525.05, 29/525.06, 243.517, 243.53, 243.54, 890.044, 897.2; 403/279, 281, 282; 296/120.1, 121, 222

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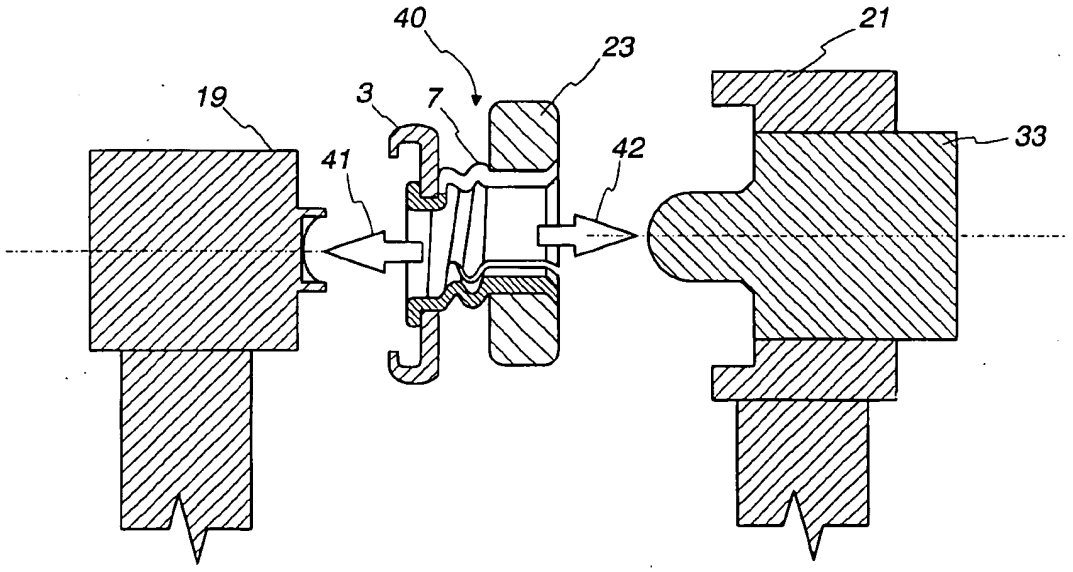
(57) **ABSTRACT**

The present invention relates to a process for the attachment of a mounting rail, as well as to a connecting device for a mounting rail. In the process for the attachment of a mounting rail to a rod which is, if necessary, at least partially premounted, of a folding top for a motor vehicle, particularly for a convertible, a tubular connecting element (**7, 7**), which has at least one stopping surface (stopping surface [**11**]), is inserted through a hole (**5**) in the mounting rail (**3**). The tubular connecting element (**7, 7'**) is inserted through an additional hole (**25**) in the rod (**23**) and secured in its position, and the mounting rail (**3**) is moved forward up to a predetermined position on the rod (**23**), whereby the tubular connecting element (**7, 7'**) is plastically deformed and a connection between the rod and the mounting rail is brought about. The connecting device in accordance with the invention comprises a tubular connecting element (**7, 7'**), which extends both through a hole (**5**) in the mounting rail (**3**) as well as through a hole (**25**) in the rod (**23**) and is, during the production of the connection point (**40**), least partially plastically deformed.

4 Claims, 2 Drawing Sheets



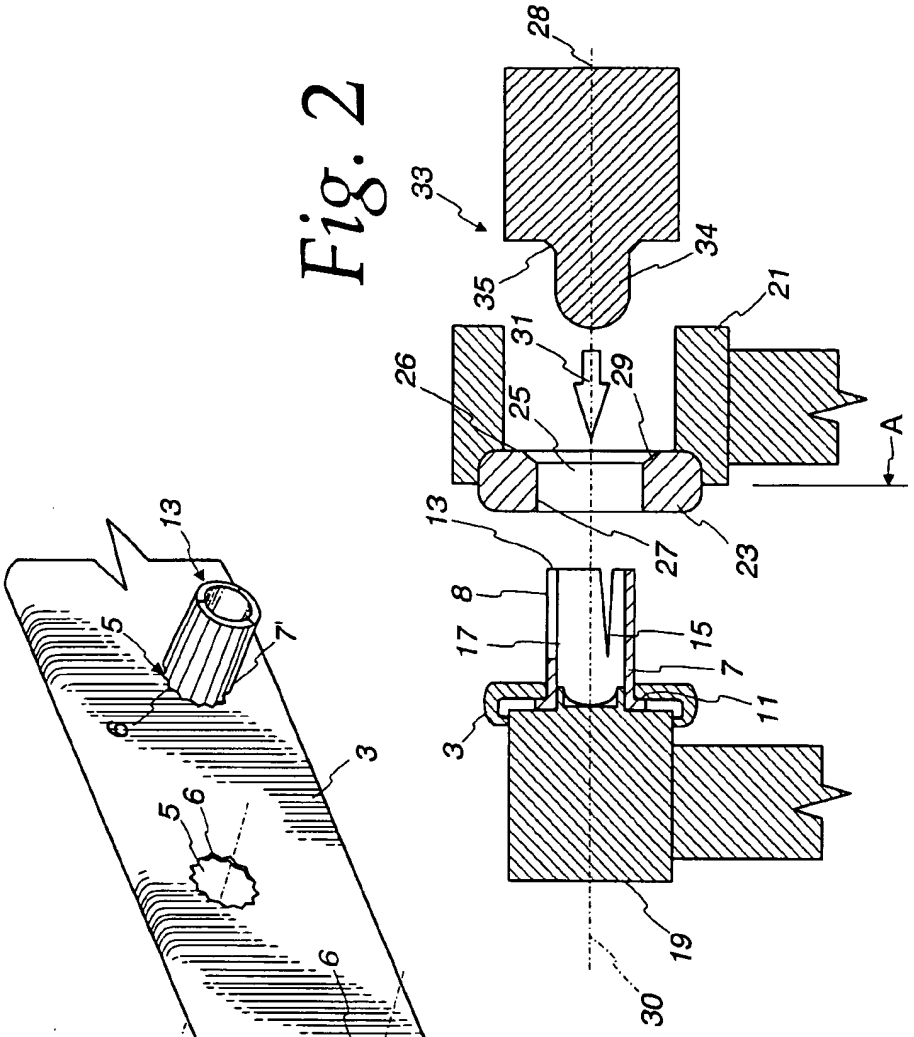

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Fig. 2

Fig. 1

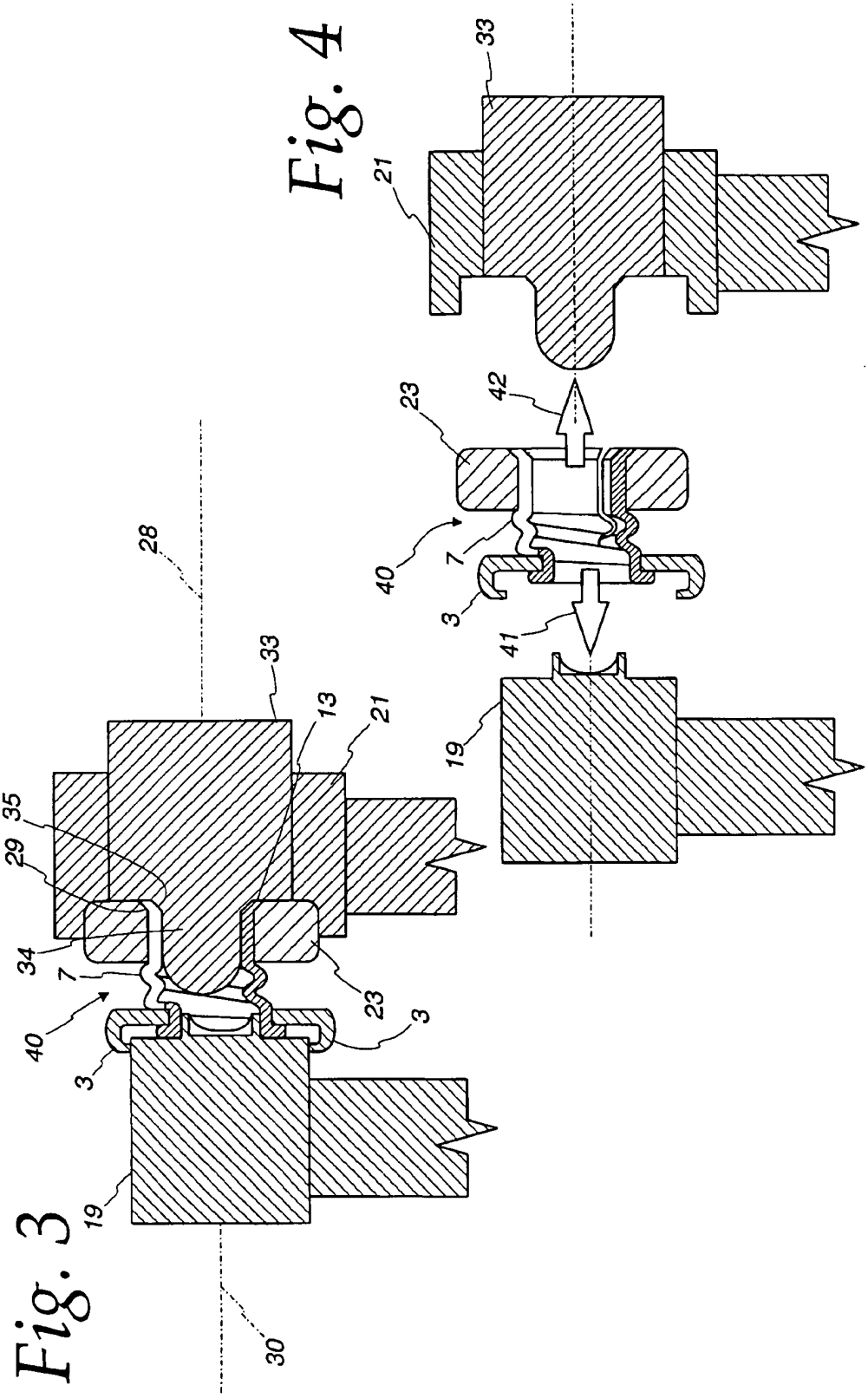


Fig. 4

Fig. 3

PROCESS FOR THE ATTACHMENT OF A MOUNTING RAIL AS WELL AS A CONNECTING DEVICE FOR A MOUNTING RAIL

BACKGROUND OF THE INVENTION

The present invention relates to a process for the attachment of a mounting rail to the rod of a folding top for a motor vehicle, particularly of a convertible, which rod is at least partially premounted, if necessary. The present invention additionally concerns a connecting device for a mounting rail for the connection of the rod to a folding top of a motor vehicle, particularly of a convertible, which rod is at least partially premounted, if necessary.

In folding tops, particularly in the folding tops of motor vehicles, the problem exists of bringing these into a sealing connection with the corresponding edge sections of the motor vehicle upon the closing of the folding top and of keeping the same permanently sealed there.

Sealing systems, in which the corresponding sealing lips of so-called mounting rails are accommodated, have been developed for this. The mounting rails are elongated, C-shaped elements, in which the opening of the "C" serves for the accommodation of sealing elements, particularly of elongated sealing strips.

Problems thereby result in the conventional simple mounting, such as the fastening of the mounting rails to the corresponding elements of the folding top rod in relation to a specific position by means of screws. Since the tolerances of the rod or of its position allow a certain clearance space, the position of the mounting rail must be correspondingly readjusted, or subsequently changed again after the mounting of the rod, so that a precise sealing effect is achieved. The adjustment of the distance of the mounting rail and of the rod is carried out, in a conventional manner, through the placement of spacing disks. This procedure is not only complicated but also extremely labor-intensive, which makes the production process considerably more expensive. In addition, the position provided can not always be reliably achieved by means of an adjustment by hand, which then leads to problems involving a lack of tightness.

SUMMARY OF THE INVENTION

The task which forms the basis of the present invention is, therefore, a process for the attachment of a mounting rail to the rod of a folding top of a motor vehicle, particularly of a convertible, which rod is at least partially premounted, if necessary, by means of which a defined securing of position is achieved, in a simple manner, through which the tolerance clearances which are brought about can be compensated.

The task which forms the basis of the present invention is, in addition, that of creating a connecting device for a mounting rail.

The solution of these tasks is achieved through the characteristics of claims **1** or **5**, respectively.

In the process in accordance with the invention, the mounting rail is provided with at least one hole at a predetermined point, a tubular connecting element, which has at least one stopping surface, is inserted through the hole, the mounting rail is mounted on a first installation element, the rod is mounted on a second installation element, whereby at least one hole is or will be provided in the said rod for the accommodation of the tubular connecting element, the tubular connecting element is inserted into the hole for the rod from the one side and is, through the insertion of a mandrel-like unit from the other side, fixed in the hole for the rod, the mounting rail is moved forward up to a predetermined position on the rod, whereby the at least one tubular connecting element is plastically deformed and a connection is created between the rod and the mounting rail, and the two connecting elements are detached from the connection point.

By that means, it is achieved that a compensation of possible tolerances is achieved up to the point that the rod can be precisely positioned in relation to the vehicle, and that the mounting rail can be sealed off in relation to the edges, whereby the positioning of the elements in the correct place, as well as the connecting of the same, can both be carried out in an essentially fully automatic process. This provides considerable advantages in relation to the speed of production, on the one hand, and in regard to the savings in expenses which is connected with the same, on the other hand, whereby the process in accordance with the invention is also particularly well suited for the production of larger unit numbers of folding tops.

The plastic deformation is, in an advantageous manner, essentially carried out through the compression deformation of the tube along its length and the expansion of a frontal edge area.

The second connecting element is advantageously attached to a mounting device which is secured in its position, and the first connecting element can be moved relative to the second connecting element, both in the horizontal direction, as well as in the vertical direction. A flexible controlling of the correct position, both of the rod as well as of the mounting rail, is thereby made possible. Possibilities for the adjustment of the mounting device can, of course, be provided.

The adjustment of the correct positions of the individual elements to one another is additionally supported by the fact that the first installation element is brought into a defined final position relative to the second installation element.

In addition, the tubular connecting element is, in an advantageous manner, inserted into a hole in the rod, which [hole] has a somewhat greater internal diameter than the external diameter of the tubular connecting elements, as the result of which a correspondingly easy insertion of the tubular element into the rod is made possible before the tubular element is, for the creation of the effective connection point, deformed in a correspondingly plastic manner.

The connecting device in accordance with the invention is characterized by the fact that at least one tubular connecting element is provided, which [element] extends both through a hole in the mounting rail as well as through a hole in the rod and is at least partially plastically deformed for the production of the connection. An effective connection point can thereby be created in the simplest manner, as the result of which additional spacing elements of the type which have previously been conventional, such as spacing disks and the like, can be avoided. The connection can consequently be created by means of a single element, or by means of a single type of element.

Several connecting elements, which make possible a correspondingly effective connection of the entire mounting rail with the rod, are advantageously provided.

The connecting elements are, in an advantageous manner, positioned in the mounting rail displaced in both the horizontal direction as well as in the vertical direction. By that means, corresponding transverse forces and lateral forces can be effectively absorbed.

The tubular connecting element advantageously has a stopping surface on one of its frontal sides, as the result of which a defined position of the element is created.

In a further advantage, the tubular connecting element has at least one notch on one of its frontal sides. This is, in an advantageous manner, the other frontal side to the one that has the stopping surface. In one preferred form of implementation, the tubular connecting element has three notches, through which corresponding tongue-like elements, which are correspondingly easily deformable, are brought about.

The tubular element is, in an advantageous manner, formed from metal, as the result of which a simple and easy deformation can be produced, and a correspondingly rigid connection between the mounting rail and the rod can be produced. It is, of course, possible to form the tubular connecting element from other materials or combinations of materials which are able to undergo a corresponding deformation, if necessary, through an additional heating of the tubular connecting element upon the starting of movement into the final position of the mounting rail relative to the rod.

DESCRIPTION OF THE DRAWINGS

Further details, characteristics and advantages of the present invention emerge from the following description with reference to the diagrams. These depict the following:

FIG. 1: In a perspective view, a mounting rail with holes and connecting elements for insertion into these holes;

FIG. 2: A form of implementation of the connecting device in accordance with the invention during the stage before the creation of the connection point;

FIG. 3: The connecting device of FIG. 2 in accordance with the invention, at the stage when the connection point has just been created; and:

FIG. 4: The connection point of FIG. 3 brought about, with the connecting elements removed.

DETAILED DESCRIPTION OF THE INVENTION

A mounting rail (3) which has, as is evident, a C-shaped profile, in which the C-shaped profile is open to the rear, is depicted in FIG. 1 in a perspective view.

Perforations or holes (5), into which the tubular connecting elements (7 and 7') can be inserted, are placed in the mounting rail (3), which is depicted in cut-away form.

Two different forms of implementation of a tubular connecting element are depicted in the representation in accordance with FIG. 1. The tubular connecting elements (7 or 7') can be inserted, in accordance with the arrow (9), into the holes (5) depicted in FIG. 1, which holes have a denticulated internal circumference (6). By means of the denticulated internal circumference (6), a similar structure is impressed onto the external circumference of the tubular connecting element (7'), as the result of which a corresponding insertion effect is brought about.

The tubular connecting elements (7, 7') have, on one frontal side (10), a stopping surface (11) which, upon the insertion of the tubular connecting elements (7, 7') against the mounting rail (3). serves as a stop unit.

On the other frontal side (13), which is positioned opposite to the frontal side (10), notches (15) are provided whereby, in the example of the connecting element (7) which is depicted, three notches (15), which are located at the same angular distance from one another, are provided.

Tongue-shaped elements (17), which make an easier deformation possible, are formed by the notches (15).

The tubular connecting elements (7, 7') can be formed from metal, for example. Possible other materials, which support or make possible a plastic deformation, are also suitable, however.

The method by which one preferred form of implementation of the process in accordance with the invention proceeds, as well as how a corresponding connecting point is created with the connecting device in accordance with the invention, is depicted in FIGS. 2 to 4.

The mounting rail (3) is attached and secured in its position on a first installation element. The tubular connecting elements (7 or also 7') are inserted into the mounting rail (3) and abut, with their specific stopping surface (11), against the mounting rail (3), on the one hand, and against the corresponding side of the corresponding connecting element (19), on the other hand.

A rod (23), which is, in the case of the example, a rail-shaped element, is accommodated in a second installation element (21). As many holes (25) are formed in the rod (23) as tubular connecting elements (7) are to be provided, although still more holes (25) may also be provided, if necessary, in order to create different possibilities for the selection of the connecting points, in accordance with the form of implementation of the folding top or of the rod.

The holes have an internal diameter (27) which is somewhat greater than the external diameter (8) of the tubular connecting elements (7, 7').

In addition, the hole or the holes (25) has (have) a phase adjustment area (29) expanding outwardly to the outside.

A mandrel-like unit (33), which has a protuberance (34) which can be inserted into the hole (25) in the direction of the arrow (31), is provided.

The rod (23), which can be premounted, if necessary, is, according to FIG. 2, located in a position at a reference plane (A) which defines a predetermined mounting position.

The process in accordance with the invention, three images of which are depicted in FIGS. 2 to 4, will now be represented by means of the following description.

Proceeding from the positions of the first connecting element (19), of the second connecting element (21), and of the mandrel-like unit (33), the tubular connecting element (7) is first inserted into the hole (25), whereby the frontal side (13) is preferably snugly inserted all the way into the rear external side (26).

After that, the protuberance (34) of the mandrel-like unit (33) is inserted into the interior of the tubular element (7). A conical surface (35), which is configured in such a manner that its tapering corresponds to the phase adjustment area (29), is positioned at the base of the protuberance (34).

Through the engagement of the conical surface (35) with the frontal side (13) of the tubular connecting element (7 or 7'), the tubular connecting element (7) is deformed in this area and a securing of position is produced at this point.

In order to fix the definitive position of the mounting rail (3) relative to the rod (23), the mounting rail is moved, by means of the first connecting element, into this position, whereby the tubular connecting element (7) is plastically deformed at the same time, as is evident from FIG. 3. The tubular connecting element (7) is completely fixed in its position by means of the said plastic deformation, and a connection point (40) is created.

As is evident from FIG. 3, the axis (28) of the hole (25) thereby diverges from the axis (30) of the tubular connecting element (7). A displacement relative to the position in accordance with FIG. 2 has consequently been brought

about, and the tolerances in the position or in the individual components have been compensated, so that the defined final position of mounting rail (3) relative to the rod (23) has been brought about. The rod is thereby positioned in the correct position for the connection device (not depicted) with the vehicle, and the mounting rail is in the correct position for an optimal sealing, such as with the side windows of the vehicle, for example.

The stage in which the first connecting element (19) has been displaced to the left by the mounting rail, in accordance with the arrow (41), and the second connecting element (21) has, along with the mandrel-like unit (33), been displaced to the right, in accordance with the arrow (42), and in which the rod (23) has been released, is depicted in FIG. 4.

The present invention is not restricted to the examples of implementation depicted. For example, the tubular connecting elements can also have another form, such as prismatic shapes, triangular cross-sectional shapes, etc., rather than a cylindrical shape. The cross-sectional shape of the holes (25) can also have other form: for example, the phase adjustment area (29) can proceed over the entire internal diameter, and thus be correspondingly less beveled. The configuration of the protuberance (34) is then adjusted in a corresponding manner.

The first and the second connecting elements (19 and 21) are attached to corresponding mounting devices, on which the rod (23) can be premounted with the additional elements. The representations in accordance with FIGS. 2 to 4 show only one side of the rod with the mounting rail. These devices are then either constructed in a correspondingly mirror-symmetrical manner on the other side of the same mounting device, or else positioned on a device which is premounted or subsequently mounted.

In order to achieve the greatest saving of time, all of the connection points (40) are produced on both sides of the folding top simultaneously.

What is claimed is:

1. A process for the attachment of a mounting rail to a rod of a folding top for a convertible, with the steps of:

providing a mounting rail which has at least one hole at a predetermined point;

providing a rod which has at least one hole at a predetermined point, the rod having a first side and a second side,

mounting the mounting rail on a first installation element;

mounting the rod on a second installation element;

inserting a tubular connecting element, which has at least one stopping surface, through the hole in the mounting rail;

introducing the tubular connecting element into the hole in the rod from the first side of the rod and fixing it, by means of the insertion of a mandrel unit from the second side of the rod, in its position in the hole in the rod;

moving the mounting rail forward towards the rod up to a predetermined position thereby plastically deforming the tubular connecting element in a space between the mounting rail and the rod and thus providing a connection between the rod and the mounting rail which are still spaced apart; and

detaching both of the installation elements and the mandrel-like unit from the rod and the mounting rail.

2. The process in accordance with claim 1, further comprising the steps of attaching the second installation element to a mounting device, which is secured in a defined position, and moving the first installation element in relation to the second installation element, both in the horizontal direction as well as in the vertical direction.

3. The process in accordance with claim 2, further comprising the step of bringing the first installation element into a defined final position relative to the second installation element.

4. The process in accordance with claim 1, further comprising the step of providing a hole in the rod, which has a somewhat larger internal diameter than an external diameter of the tubular connecting element.

* * * * *

Feb. 23, 1937. J. W. DEWS 2,071,507

METHOD OF APPLYING FASTENERS TO SHEET LIKE MATERIAL

Original Filed April 29, 1935

Fig. 10.

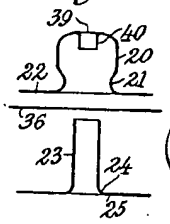


Fig. 1.

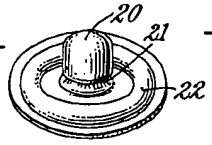


Fig. 11.

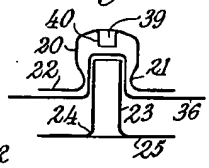


Fig. 4.

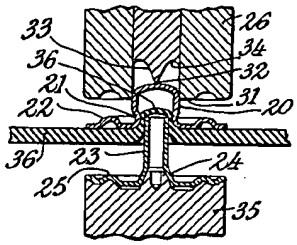


Fig. 2.

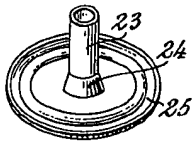


Fig. 5.

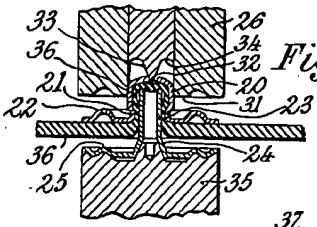


Fig. 6.

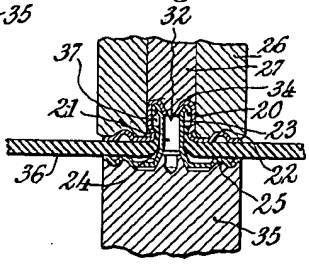


Fig. 12.

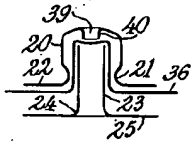


Fig. 3.

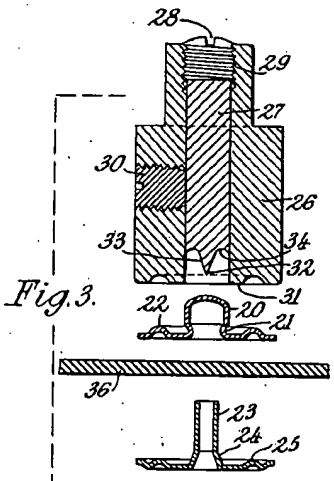
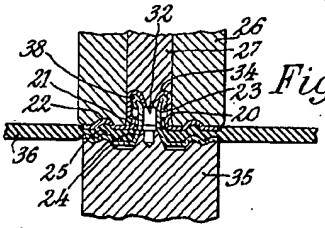


Fig. 7.



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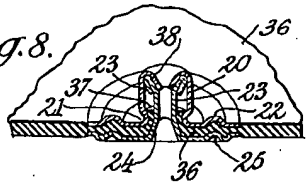


Fig. 13.

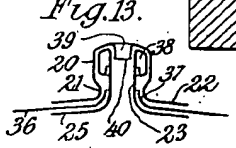
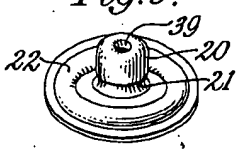


Fig. 9.



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UNITED STATES PATENT OFFICE

2,071,507

METHOD OF APPLYING FASTENERS TO SHEET LIKE MATERIAL

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Original application April 29, 1935, Serial No. 18,824. Divided and this application May 13, 1936, Serial No. 79,539

3 Claims. (Cl. 218—29)

This invention relates to improvements in methods of applying fastening devices to garments, or other materials, of which they are intended to form parts, and is a division of my copending application Serial No. 18,824, filed April 29, 1935. Although such methods may be used with a wide variety of fasteners, and may be carried out by any one of a wide variety of tools, the novel features of the invention are particularly designed for use in making and securing garment fasteners to articles of wearing apparel, and are herein disclosed in connection with the application of the stud element of a snap fastener of the ball and socket type to a sheet of rubber or equivalent elastic material.

When utilizing the method of the present invention for applying fastener elements to garments or the like, the parts of the fastener need comprise nothing more than a pair of loosely telescoping flanged elements which may, as a matter of convenience, be referred to respectively as a stud and an eyelet. The stud-entering end of the eyelet need not be sharpened and should be of a diameter somewhat smaller than the opening in the stud, so that when the stud and eyelet are telescoped one within the other, with the elastic sheet material between them, the part of the sheet material immediately overlying the entering end of the eyelet will be stretched and thrust into the opening in the stud, the loose fit between the eyelet and the stud being such as to afford ample space for the elastic material to enter. When the eyelet has been forced into the stud to such a degree that its open entering end is approaching the under side of the dome of the stud, the elastic material which is stretched over the entering end is pierced. The latter may be accomplished by means of a piercing tool, or, if desired, the dome of the stud may be so designed as to effect this result. In any event, the stretched rubber, after being pierced, extends around the perforation and is drawn backwardly towards the base of the eyelet so as to relieve the strain on the rubber and leave a large portion of the inserted end of the eyelet bare. The stud and the eyelet may then be pressed between appropriate anvils, one of which engages the stud, and the other of which engages the base of the eyelet so as to cause the inserted end of the eyelet to be rolled outwardly around the flaring walls of the mandrel into a clinching engagement with the surrounding portion of the stud which is nested within a recess in the part of the anvil which surrounds the mandrel. By thus forcing the eyelet into the stud and rolling its end into engaging relation with the inner part of the head of the stud, the flanges of the stud and eyelet may be brought into a close engaging relationship with the sheet material immediately surrounding the inserted part of the eyelet, which will have been relieved from anything in the nature of excessive strain and restored to approximately normal condition after being perforated and before being clamped between the flanges of the stud and eyelet so as to lie flat and smooth without any puckers or wrinkles after the fastener has been applied.

The attached fastener as applied to the article on which it is to be used differs from known constructions of the prior art in that the elastic material, although no part of it has been cut out and removed, is drawn clear of the portion of the eyelet which is rolled into an engaging relation with the inner wall of the stud, and although clamped between the flanges of the stud and eyelet, the edge portion which surrounds the eyelet has no tendency to expand the walls of the protuberant portion of the stud at its base since the designed loose fit between the stud and the eyelet is such as to provide space for the entrance of the stretched rubber when the eyelet is first thrust into the stud and for the withdrawal of the rubber surrounding the eyelet after it has been perforated by the setting tool.

In the accompanying drawing illustrating a preferred form of the invention,—

Figure 1 is a perspective view of a conventional form of snap fastener stud.

Fig. 2 is a conventional form of eyelet which might be used in securing the stud of Fig. 1 to a part of a rubber garment or other article of sheet material. These two parts need not differ from those commonly used in the prior art other than that the portion of the eyelet intended to enter the opening in the back of the stud should be of slightly smaller diameter than would ordinarily be used in order to allow the sheet material to enter and be withdrawn.

Fig. 3 is an axial cross-sectional view through a stud, an eyelet, a sheet of material to which the stud and eyelet are to be applied, a conventional form of anvil to be used in inserting the eyelet, and a setting tool for the stud comprising a pointed mandrel and anvil embodying the hereindisclosed invention.

Figs. 4, 5, 6 and 7 are similar cross-sectional views of the parts illustrated in Fig. 3, such parts being represented in different positions to which they are successively moved when applying the

stud and eyelet to the intervening sheet of elastic material.

Fig. 8 is a view, partly in axial cross section and partly in perspective, representing a snap fastener stud and eyelet secured to a sheet of elastic material.

Fig. 9 is a perspective view of a modified form of fastener stud which may be used in practicing the invention.

Fig. 10 is a diagrammatic cross-sectional view of another modified form of the invention, the parts illustrated representing a fastener stud, eyelet and an intervening piece of sheet material, the stud having a piercing element extending downwardly from its inner upper surface.

Fig. 11 is a similar view of the same parts, the end of the eyelet being represented as having been thrust into the stud and as having stretched a part of the sheet material over its upper end.

Fig. 12 is a similar view of the same fastener parts, the eyelet being represented as having been thrust farther into the stud to a position such that further movement will cause the sheet material to be punctured.

Fig. 13 is a similar view of the same elements, the fastener parts being represented as having been secured to the sheet material.

As has already been explained, the stud illustrated by Fig. 1 is of conventional form comprising the usual head 20, neck 21 and flange 22. Likewise, the eyelet may be of conventional form comprising a hollow cylindrical post 23, base 24 and flange 25.

The setting tool for the stud in accordance with the method of the present invention, as best illustrated in Fig. 3, may comprise a body portion 26 and a core 27 telescoped one within the other. The core may be adjustably secured within the body portion in any appropriate manner with its lower end slightly above the lower end of the body portion. In the form of the invention herein disclosed the upper end of the core 27 is slotted as at 28 and has threaded engagement as at 29 with the inner wall of the body portion so that by the use of an ordinary screw-driver, the position of the core within the body portion may be readily adjusted, and, if desired, the core may be held in any such position of adjustment, in any suitable manner, as by the use of a set-screw 30 in the body portion having its end so positioned that it may be forced into clamping engagement with the surface of the core.

The lower working face 31 of the body portion of the setting tool should be of a form such as to serve as an anvil for the flange of the stud, and the opening in the body portion of the tool which receives the core 27 should be of a diameter such that its lower end may serve as a recess of a size adapted to receive the head of the stud.

At the center of the lower end of the core is a part which may be properly referred to as a mandrel, having a pointed end as at 32 and an outwardly flaring wall 33 of substantially conical form merging into an annular curved surface 34 which serves as an anvil for the head of a fastener stud during a setting operation.

The anvil 35 should have an upper working surface adapted to conform with that of the base of the eyelet to be used in securing the stud to an intervening sheet of rubber or other elastic material 36.

The stud and eyelet illustrated in Fig. 3 may be secured to the sheet material 36 by the use of any appropriate machine (not shown) adapted to force the setting tool 26, 27 and anvil 35 towards each other. Machines operated by hand power, foot power, and what are known as automatic machines, adapted for use in thus securing fastener parts to sheet material are well known in the prior art and need not be herein specifically disclosed.

The approximate relative movements of the parts of the fastener elements and setting tools during a setting operation are illustrated in Figs. 4 to 7, inclusive, it being understood, of course, that the relative degree of movement of the different parts with respect to one another may vary to some extent and might not exactly conform with the conventional representation in the various figures of the drawing. In Fig. 4 the stud is represented as having been moved into the recess in the lower part of the setting tool with the center of its head in contact with the perforating point 32. In the same view the upper end of the eyelet is represented as having engaged and stretched the overlying part of the sheet of elastic material 36 and forced it into the opening in the base of the stud. In Fig. 5 the eyelet is represented as having forced the stretched overlying elastic material to a position quite close to the under surface of the head of the stud, and the perforating point of the setting tool is represented as having been thrust through the wall of the head of the stud to a position in which it is in readiness to perforate the underlying portion of the sheet of elastic material. In Fig. 6 the elastic material is represented as having been perforated and the edges of the portion surrounding the perforation are represented as having been stretched outwardly sufficiently to snap down towards the base of the eyelet to the positions indicated at 37, Fig. 6. In this figure the eyelet is represented as having been thrust upwardly to a position such that its entering end surrounding the flaring wall 33 of the mandrel has been rolled over after making contact with the under surface of the head of the stud, the flange 25 of the eyelet and the flange 22 of the stud approaching the positions in which they will clamp the elastic material 36 between them.

In Fig. 7 the setting operation is indicated as having been completed. The upper end of the eyelet and the adjacent portion of the head of the stud are represented at 38 as having been rolled into a clinching engagement with each other by the flaring wall 33 of the mandrel and surrounding wall 34 of the core 27 of the tool. The flanges 22, 25 of the stud and eyelet are also represented as having been pressed into clamping engagement with the portion of the sheet of elastic material 36 surrounding the part through which the post of the eyelet has been inserted.

Fig. 8 represents the stud and eyelet as having been attached to the sheet of elastic material and the setting tools withdrawn. It will be apparent that since the stretched portion of the sheet of elastic material has been perforated and permitted to expand and slip down towards the base of the eyelet, there will be no layer of intervening elastic material to interfere with the satisfactory clinching of the upper end of the eyelet in the head of the stud, and since the annular space between the post of the eyelet and the inner wall of the stud is such as to provide for a free movement of the stretched elastic material, the part of the elastic material to which the fastener elements are secured is permitted to return to a substantially normal condition be-

fore it is clamped between the flanges 22, 25 of the stud and eyelet, thus avoiding any wrinkling of the surrounding material.

In Figs. 3 to 7, inclusive, the stud is represented as one having an imperforate head which is perforated by the point 32 of the setting tool during a setting operation. In Fig. 9 is illustrated a modified form of stud having a centrally-disposed perforation 39 in its head through which the point 32 of the setting tool may enter and then perforate the underlying elastic material to which the stud is to be secured. The perforation may be made with an ordinary drift-pin, and, if desired, the knurled burr may be removed before securing the stud to the article on which it is to be used. When using this preperforated form of fastener element it may be immediately thrust to a seated position in the recess in the setting tool, that is, to the position indicated in Fig. 6, at the initial stage of the setting operation, illustrated by Fig. 4, with the point 32 of the mandrel extended through the perforation in the fastener element in readiness to perforate the elastic material when forced against it by the upper end of the eyelet as it is moved towards the position in which it is illustrated in Fig. 6.

The stud and eyelet or other fastening elements to which the invention is applied may be made of any appropriate metal or alloy. If used on rubber, aluminum or some other non-copper content metal would serve as a satisfactory material for the fastener elements.

As already explained, the perforated fastener of the character of the one illustrated by Fig. 9 may be applied to the sheet material, on which it is to be used, with the aid of the tool illustrated in Fig. 3, whether or not the inturned burr of metal surrounding the perforation 39 has been removed. If the burr is permitted to remain, the form and dimensions of the mandrel may be such that the point 32 will extend below the burr and serve as a means of perforating the underlying sheet material during a fastening operation before the sheet material is brought into contact with the burr.

As distinguished from the form in which the invention has been presented by Figs. 1 to 9, inclusive, and the description thereof, Figs. 10 to 13, inclusive, illustrate in diagram a modified form in accordance with which the head of the fastener element represented as a stud has a portion of the fastener wall surrounding a centrally-disposed perforation in the head of the stud extended downwardly so that it may serve as a means of puncturing sheet material when thrust into contact therewith and not be dependent upon the use of a setting tool having a pointed puncturing element to be thrust through the perforation.

In Fig. 10 is represented in diagram a stud having a head 20, neck 21, flange 22 and perforation 39, conforming with the stud illustrated by Fig. 9. There is also represented in Fig. 10 an eyelet having a post 23, base 24 and flange 25, similar to the one illustrated by Fig. 2. 36 of the diagram is representative of a piece of sheet material to which the stud and eyelet may be secured.

The stud illustrated in Fig. 10 is represented as having a portion of the metal wall of the fastener immediately surrounding the perforation 39 turned inwardly so as to form a downwardly-extending tubular projection 40, which might comprise the burr which would result from the use of an ordinary drift-pin as the means of perforating the head of the stud, or the extension 40 might be formed in any other appropriate manner. As will be shown, this burr or equivalent inwardly and downwardly extended tubular portion of the fastener may serve as a means of puncturing elastic sheet material when thrust into the fastener element by an eyelet during the operation of securing parts of the fastener to the material on which they are to be used.

In Fig. 11 the end of the eyelet post is represented as having been caused to stretch the overlying portion of the sheet material 36 and as having thrust a portion of the material into the hollow portion of the stud.

In Fig. 12 the post 23 of the eyelet is represented as having been thrust farther into the hollow part of the stud and the overlying stretched portion of the sheet material is represented as having been brought into contact with the edge portion of the extension 40, so that further movement of the post will cause the stretched sheet material to be punctured.

In Fig. 13 the parts represented in Figs. 10, 11 and 12 are illustrated as having been firmly secured together. It will be understood that the puncturing of the stretched elastic material overlying the end of the post, by a slight advance movement of the post from the position represented in Fig. 12, will cause the punctured elastic material to slip over and down the wall of the post to a position near the base as represented at 37, Fig. 13. Following this puncturing of the stretched elastic material and the drawing away of the material from the upper part of the post of the eyelet, further telescoping movement of the stud and eyelet causes the upper end of the post to be rolled outwardly about the tubular extension 40 and downwardly along the inner walls of the head of the stud to a clinching engagement with the stud head, as indicated at 38 in Fig. 13.

The puncturing of the stretched elastic material so as to permit the portion distorted by thrusting the post into the stud to be relieved of strain, and to permit the parts surrounding the post of the eyelet to be restored substantially to their normal condition before moving the flanges 22 and 25 of the stud and eyelet from the positions represented in Fig. 12 to the clamping position represented in Fig. 13, tends to prevent the wrinkling or puckering of the sheet material surrounding the attached parts of the fastening element.

The methods of the present invention are not intended to be limited to the precise steps herein described, nor to use with the exact forms of fasteners and tools herein illustrated, but should be regarded as including modifications and variations within the scope of the appended claims.

What I claim is:

1. The method of securing a pair of fastener elements, of dimensions and forms such that they may be loosely telescoped one within the other, to elastic sheet material, which consists in inserting one element in the opening in the other with the elastic material between them, thus causing the material overlying and closely surrounding the end of the inserted element to be stretched and forced into the other, puncturing the stretched elastic material underlying the exposed end of the outer element so as to permit the part surrounding the puncture to be drawn back away from the inserted end of the inner element towards the plane of the surrounding

body portion of the sheet material, and securing the two fastener elements together by pressing them towards each other in an axial direction between a pair of anvils so as to thrust the inserted element further into the outer element and thus cause the inserted end to be rolled into a clinching engagement therewith.

2. The method of securing a pair of fastener elements, of dimensions and forms such that they may be loosely telescoped one within the other, to elastic sheet material, which consists in inserting one element in the opening in the other with the elastic material between them, thus causing the material overlying and closely surrounding the end of the inserted element to be stretched and forced into the other, thrusting a pointed tool through the exposed end of the outer element and into the underlying stretched elastic material so as to perforate the same and permit the part surrounding the perforation to be drawn back away from the inserted end of the inner element towards the plane of the surrounding body portion of the sheet material, and securing the two fastener elements together by pressing them towards each other in an axial direction between a pair of anvils so as to thrust the inserted element further into the outer element and thus cause the inserted end to be rolled into a clinching engagement with the outer element in the space surrounding the inserted end portion of the pointed tool.

3. The method of securing a pair of fastener elements of dimensions and form such that they may be loosely telescoped one within the other in accordance with claim 1 in which the elastic material overlying the exposed end of the inner element is punctured by being brought into contact with a downwardly projecting portion of the outer element.

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